CLAIMS

1.   An optical disk unit having reproducing means for reproducing information recorded in an information recording layer of an optical disk, comprising:

a laser beam source;

an aberration corrector to correct a spherical aberration by adjusting the diverging or converging angle of a laser beam emitted from the laser beam source;

an objective lens to condense the laser beam and form a condensed beam spot on the information recording layer;

a focus controller having a moving mechanism to move the objective lens along an optical axis of the laser beam, the focus controller moving the objective lens so that the condensed beam spot focuses on the information recording layer;

detecting means for allowing the focus controller to move the objective lens by a predetermined distance from an in-focus position in a first direction, allowing the reproducing means to reproduce a random signal having a plurality of amplitudes and periods from an optional area of the information recording layer, extracting a specific portion having a specific amplitude or period from the reproduced random signal or an interpolated signal thereof, finding a first amplitude value in the specific portion, allowing the focus controller to move the objective lens by the predetermined distance from the in-focus position in a second direction that is opposite to the first direction, allowing the reproducing means to reproduce a random signal having a plurality of amplitudes and periods from the optional area of the information recording layer, extracting a specific portion having a specific amplitude or period from the reproduced random signal or an interpolated signal thereof, and finding a second amplitude value from the specific portion; and

controlling means for controlling the aberration corrector so that the difference between the first amplitude value and the second amplitude value approaches zero.

2.   The optical disk unit as set forth in claim 1, further comprising:

determining means for determining whether or not the information recording layer has a record to reproduce a random signal by the detecting means; and

recording means for recording a random signal having a plurality of amplitudes

and periods in the optional area of the information recording layer if the determining means determines that the information recording layer has no record to reproduce a random signal by the detecting means.

3.   The optical disk unit as set forth in claim 2, wherein:

the optional area is an OPC area.

4.   The optical disk unit as set forth in claim 1, wherein:

the detecting means is an envelope detector to detect envelopes in the specific portions and find the first and second amplitude values.

5.   An optical disk unit having reproducing means for reproducing information recorded in an information recording layer of an optical disk, comprising:

a laser beam source;

an aberration corrector to correct a spherical aberration by adjusting the diverging or converging angle of a laser beam emitted from the laser beam source;

an objective lens to condense the laser beam and form a condensed beam spot on the information recording layer;

a focus controller having a moving mechanism to move the objective lens along an optical axis of the laser beam, the focus controller moving the objective lens so that the condensed beam spot focuses on the information recording layer;

detecting means for allowing the focus controller to move the objective lens by a predetermined distance from an in-focus position in a first direction, allowing the reproducing means to reproduce a random signal having a plurality of amplitudes and periods from an optional area of the information recording layer, extracting a first specific portion having a first specific amplitude or period and a second specific portion having a second specific amplitude or period from the reproduced random signal or an interpolated signal thereof, finding a first differential value between an amplitude value of the first specific portion and an amplitude value of the second specific portion, allowing the focus controller to move the objective lens by the predetermined distance from the in-focus position in a second direction that is opposite to the first direction, allowing the reproducing means to reproduce a random signal having a plurality of amplitudes and

periods from the optional area of the information recording layer, extracting a third specific portion having a third specific amplitude or period and a fourth specific portion having a fourth specific amplitude or period from the reproduced random signal or an interpolated signal thereof, and finding a second differential value between an amplitude value of the third specific portion and an amplitude value of the fourth specific portion; and

controlling means for controlling the aberration corrector so that the difference between the first differential value and the second differential value approaches zero.

6. The optical disk unit as set forth in claim 5, further comprising:

determining means for determining whether or not the information recording layer has a record to reproduce a random signal by the detecting means; and

recording means for recording a random signal having a plurality of amplitudes and periods in the optional area of the information recording layer if the determining means determines that the information recording layer has no record to reproduce a random signal by the detecting means.

7. The optical disk unit as set forth in claim 6, wherein:
the optional area is an OPC area.

8. The optical disk unit as set forth in claim 5, wherein the detecting means comprises:

zero-cross detecting means for detecting a zero-cross point where the reproduced random signal or an interpolated signal thereof crosses a preset zero level;

time interval detecting means for detecting a time interval between two adjacent zero-cross points; and

extracting means for extracting the first to fourth specific portions according to time intervals detected by the time interval detecting means.

9. The optical disk unit as set forth in claim 5, wherein the detecting means comprises:

zero-cross detecting means for detecting a zero-cross point where the reproduced random signal or an interpolated signal thereof crosses a preset zero level;

partial response determining means for using zero-cross points detected by the zero-cross detecting means and the reproduced random signal or an interpolated signal thereof, to determine a target value for each sampling point of the reproduced random signal or an interpolated signal thereof according to run-length limitation and state transition determined by partial response characteristics; and

extracting means for extracting the first to fourth specific portions according to target values determined by the partial response determining means.

10. An optical disk unit having reproducing means for reproducing information recorded in an information recording layer of an optical disk, comprising:

a laser beam source;

an aberration corrector to correct a spherical aberration by adjusting the diverging or converging angle of a laser beam emitted from the laser beam source;

an objective lens to condense the laser beam and form a condensed beam spot on the information recording layer;

a focus controller having a moving mechanism to move the objective lens along an optical axis of the laser beam, the focus controller moving the objective lens so that the condensed beam spot focuses on the information recording layer;

a waveform equalizer for setting a boost quantity for a signal reproduced by the reproducing means from information recorded in the information recording layer and equalizing the waveform of the reproduced signal;

detecting means for allowing the focus controller to move the objective lens by a predetermined distance from an in-focus position in a first direction, allowing the reproducing means to reproduce a random signal having a plurality of amplitudes and periods from an optional area of the information recording layer, detecting a first boost quantity used by the waveform equalizer for the reproduced random signal, allowing the focus controller to move the objective lens by the predetermined distance from the in-focus position in a second direction that is opposite to the first direction, allowing the reproducing means to reproduce a random signal having a plurality of amplitudes and periods from the optional area of the information recording layer, and detecting a second boost quantity used by the waveform equalizer for the reproduced random signal; and

controlling means for controlling the aberration corrector so that the difference

between the first boost quantity and the second boost quantity approaches zero.

11. An aberration correcting method used for an optical disk unit, comprising:

a reproducing step of reproducing a random signal having a plurality of amplitudes and periods from an optional area of an information recording layer of an optical disk;

a focusing step of moving an objective lens along an optical axis, to condense a laser beam emitted from a laser beam source on the information recording layer and focus the condensed beam spot on the information recording layer;

a first detecting step of moving the objective lens by a predetermined distance from the in-focus position set in the focusing step in a first optical axis direction, reproducing the random signal, extracting a specific portion having a specific amplitude or period from the reproduced random signal or an interpolated signal thereof, and finding a first amplitude value in the specific portion;

a second detecting step of moving the objective lens by the predetermined distance from the in-focus position set in the focusing step in a second direction that is opposite to the first direction, reproducing the random signal, extracting a specific portion having a specific amplitude or period from the reproduced random signal or an interpolated signal thereof, and finding a second amplitude value in the specific portion; and

a controlling step of controlling an aberration corrector that corrects a spherical aberration by adjusting the diverging or converging angle of the laser beam, so that the difference between the first amplitude value and the second amplitude value approaches zero.

12. The aberration correcting method used for an optical disk unit as set forth in claim 11, further comprising before the reproducing step:

a determining step of determining whether or not the information recording layer has a record to reproduce a random signal in the first and second detecting steps; and

a recording step of recording a random signal having a plurality of amplitudes and periods in the optional area of the information recording layer if the determining step determines that the information recording layer has no record to reproduce a random signal in the first and second detecting steps.

13.   The aberration correcting method used for an optical disk unit as set forth in claim 12, wherein:

the optional area is an OPC area.

14.   The aberration correcting method used for an optical disk unit as set forth in claim 11, wherein:

the first and second detecting steps are envelope detecting steps of detecting envelopes in the specific portions and finding the first and second amplitude values.

15.   An aberration correcting method used for an optical disk unit, comprising:

a reproducing step of reproducing a random signal having a plurality of amplitudes and periods from an optional area of an information recording layer of an optical disk;

a focusing step of moving an objective lens along an optical axis, to condense a laser beam emitted from a laser beam source on the information recording layer and focus the condensed beam spot on the information recording layer;

a first detecting step of moving the objective lens by a predetermined distance from the in-focus position set in the focusing step in a first optical axis direction, reproducing the random signal, extracting a first specific portion having a first specific amplitude or period and a second specific portion having a second specific amplitude or period from the reproduced random signal or an interpolated signal thereof, and finding a first differential value between an amplitude value of the first specific portion and an amplitude value of the second specific portion;

a second detecting step of moving the objective lens by the predetermined distance from the in-focus position set in the focusing step in a second direction that is opposite to the first direction, reproducing the random signal, extracting a third specific portion having a third specific amplitude or period and a fourth specific portion having a fourth specific amplitude or period from the reproduced random signal or an interpolated signal thereof, and finding a second differential value between an amplitude value of the third specific portion and an amplitude value of the fourth specific portion; and

a controlling step of controlling an aberration corrector that corrects a spherical

aberration by adjusting the diverging or converging angle of the laser beam, so that the difference between the first differential value and the second differential value approaches zero.

16. The aberration correcting method used for an optical disk unit as set forth in claim 15, further comprising before the reproducing step:

a determining step of determining whether or not the information recording layer has a record to reproduce a random signal in the first and second detecting steps; and

a recording step of recording a random signal having a plurality of amplitudes and periods in the optional area of the information recording layer if the determining step determines that the information recording layer has no record to reproduce a random signal in the first and second detecting steps.

17. The aberration correcting method used for an optical disk unit as set forth in claim 16, wherein:

the optional area is an OPC area.

18. The aberration correcting method used for an optical disk unit as set forth in claim 15, wherein the first and second detecting steps include:

a zero-cross detecting step of detecting a zero-cross point where the reproduced random signal or an interpolated signal thereof crosses a preset zero level;

a time interval detecting step of detecting a time interval between two adjacent zero-cross points; and

an extracting step of extracting the first to fourth specific portions according to time intervals detected in the time interval detecting step.

19. The aberration correcting method used for an optical disk unit as set forth in claim 15, wherein the first and second detecting steps include:

a zero-cross detecting step of detecting a zero-cross point where the reproduced random signal or an interpolated signal thereof crosses a preset zero level;

a partial response determining step of using zero-cross points detected in the zero-cross detecting step and the reproduced random signal or an interpolated signal

thereof and determining a target value for a sampling point of the reproduced random signal or an interpolated signal thereof according to run-length limitation and state transition determined by partial response characteristics; and

an extracting step of extracting the first to fourth specific portions according to target values determined in the partial response determining step.

20. An aberration correcting method used for an optical disk unit, comprising:

a reproducing step of reproducing a random signal having a plurality of amplitudes and periods from an optional area of an information recording layer of an optical disk;

a focusing step of moving an objective lens along an optical axis, to condense a laser beam emitted from a laser beam source on the information recording layer and focus the condensed beam spot on the information recording layer;

a first waveform equalizing step of moving the objective lens by a predetermined distance from the in-focus position set in the focusing step in a first optical axis direction, reproducing the random signal, setting a first boost quantity for the reproduced random signal, and equalizing the waveform of the reproduced random signal;

a first detecting step of detecting the first boost quantity set in the first waveform equalizing step;

a second waveform equalizing step of moving the objective lens by the predetermined distance from the in-focus position set in the focusing step in a second direction that is opposite to the first direction, reproducing the random signal, setting a second boost quantity for the reproduced random signal, and equalizing the waveform of the reproduced random signal;

a second detecting step of detecting the second boost quantity set in the second waveform equalizing step; and

a controlling step of controlling an aberration corrector that corrects a spherical aberration by adjusting the diverging or converging angle of the laser beam, so that the difference between the first boost quantity and the second boost quantity approaches zero.